

REMARKS

Claim 20 is amended. Claims 10-15, 20, 28, 31, 33 and 87 are pending in the application. Claims 10-11, 31 and 33 are withdrawn from consideration. Claims 12-15, 20, 28 and 87 are currently under consideration.

Claims 14-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee I (U.S. Patent Publication No. 2004/0238872) as combined with Lee II (U.S. Patent No. 7151039); Yamamoto (U.S. Patent No. 6936901); and Ahn (U.S. Patent No. 7135421). Each of claims 14 and 15 recites an ALD pulse sequence of TMA-(M₂-ozone)_x, where x is an integer greater than or equal to 2, and M₂ is either TMEAH (claim 14) or TDMAH (claim 15). Lee I specifically discloses providing an amount of an Hf precursor into an ALD chamber, followed by an Al precursor, followed by oxidant. Lee does not disclose or suggest the recited introduction of TMA in the first pulse or the recited repeated rounds of Hf precursor followed by ozone.

Lee II is relied upon as disclosing Hf precursors. However such teaching does not overcome the deficiencies of Lee I set forth above. Yamamoto is relied upon as disclosing introducing aluminum prior to Hf. However, Yamamoto specifies oxidant after each of aluminum and Hf precursors as is conventional and which does not achieve the improvement in conformality obtained as does the recited pulse sequence. Ahn is relied upon as disclosing a pulse sequence utilizing repeated rounds of Hf-oxidant. However Ahn also teaches oxidant following the aluminum pulse as utilized in conventional technology and which the recited invention avoids. The combination of Ahn and Yamamoto, which teach oxidant after each and every metal pulse, and Lee which teaches Hf first, followed by

Al, does not disclose or suggest the claims 14 and 15 recited TMA-(M2-ozone)x deposition method.

Additionally, the order of pulse sequence in the absence of oxidant after the first metal precursor is a result effective variable in that it affects the relative amounts of the two metals incorporated into the resulting material (see applicants specification at paragraph 41). Accordingly, claims 14-15 are not rendered obvious by the cited combination of Lee I, Lee II, Yamamoto and Ahn and are allowable over these references.

Claims 12-13, 20, 28 and 87 stand rejected as being unpatentable over Lee I, Lee II and Yamamoto. As amended, claim 20 recites providing a first precursor followed by providing a second precursor provided by providing a reactant comprising nitrogen or silicon. The first or second reactant comprises TMA and the other is TDMAH or TMEAH. The amendment to claim 20 is supported by the specification at, for example, paragraphs 32 and 44. Not one of the cited references, or any combination thereof, discloses or suggests the claim 20 recited method utilizing a silicon or nitrogen-comprising reactant. Claim 20 is therefore not rendered obvious by the cited combination of Lee I, Lee II and Yamamoto and is allowable over these references.

Claim 28 is allowable over Lee I, Lee II and Yamamoto for at least the reason that it depends from allowable base claim 20.

Independent claim 87 recites and ALD pulse sequence M1-M2-R where M1 or M2 is TMA and the other is TDMAH or TMEAH and R is a reactant that react with one or both of M1 and M2, and where the use of TMA improves the conformality of the resulting Hf-containing material that would occur in the absence of TMA. The Examiner indicates that

the improvement in conformity would be inherent if the techniques of the cited references were combined. As acknowledged by the Examiner, the recited improvement is not inherent in Lee I. Nor does the HF precursors taught by Lee II contribute toward the recited improvement. As indicated above, Yamamoto specifically indicates utilizing oxidant after each metal pulse. This conventional-type pulse sequence does not achieve the recited improvement. Accordingly, as combined with Lee I and Lee II, Yamamoto does not contribute toward providing inherency of the recited improvement in conformity and claim 87 is not rendered obvious by Lee I, Lee II and Yamamoto.

Claims 12-13 are allowable over Lee I, Lee II and Yamamoto for at least the reason that they depend from allowable base claim 87.

For the reasons discussed above, claims 12-15, 20, 28 and 87 are allowable. Accordingly, applicant respectfully requests that the Examiner's next action be a Notice of Allowance allowing such claims.

Respectfully submitted,

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